User's Manual

Renesas Demonstration Kit (**RDK**) for **RL78G14** (REV 2)

User's Manual: Hardware

RENESAS MCU

RL78G14 Family

Release 1.0

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Precautions

This Renesas Demonstration Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

- Ensure attached cables do not lie across the equipment
- Reorient the receiving antenna
- Increase the distance between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected
- Power down the equipment when not in use
- Consult the dealer or an experienced radio/TV technician for help NOTE: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

The Renesas Demonstration Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

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Chapter 1. Preface

Cautions

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Website: http://www.renesas.com/

Glossary

ADC	Analog to Digital Converter	MCU	Microcontroller Unit
CPU	Central Processing Unit	NC	No Connection
DAC	Digital to Analog Converter	PC	Program Counter
EMC	Electromagnetic compatibility	PMOD	Peripheral Module
ESD	Electrostatic Discharge	RAM	Random Access Memory
I/O	Input / Output	ROM	Read-Only Memory
LCD	Liquid Crystal Display	RDK	Renesas Demonstration Kit
LED	Light Emitting Diode	SDRAM	Synchronous Dynamic Random Access Memory
Wi-Fi	IEEE 802.11 standards		
		E INK	Electronic Ink technology.

Chapter 2. Purpose

This RDK is an evaluation and demonstration tool for Renesas RL78 low-power microcontrollers. The goal is to provide the user with a powerful debug and demonstration platform targeted at common applications. A set of human/machine interfaces are tightly integrated with the features of the RL78 and the software demonstration programs providing the user with an accessible platform to rapidly evaluate and customize.

Target Applications and Features:

Audio

- Stereo audio driver connected to the PWM and DAC interfaces
- Amplified on-board speaker and external Stereo audio jack.
- On-board MEMS microphone to demonstrate sampling and recording capabilities (ADI)
- Volume Control Potentiometer, connected to ADC input.

User Interface

- OKAYA Graphical LCD
- E Ink Corporation Display
- User pushbutton switches and a reset switch.
- 12 on-board LEDs (LED Wheel pattern)

Communications

- On-board Wi-Fi 802.11b Module from GainSpan Corporation
- RS-232 Interface
- I^2C, SPI with Debug through the Beagle connector from Total Phase
- Application Header to support several external Wi-Fi modules.
- PMOD connections to support a variety of generic PMOD devices (Wi-Fi, Bluetooth, RF, motor control etc…).

Memory Storage

- Micro SD card slot
- 512KB Serial EEPROM (Renesas)

- 256KB On-chip Flash Memory (program)
- 8KB On-Chip Flash Memory (Data)
- 8Mbit Serial Flash for Web Server data storage (Micron)

Digital Sensors

- 3 – Axis Accelerometer (ADI)
- Temperature Sensor (ADI)
- Ambient Light Sensor (CEL)

Power Control

- FET Circuit for DC output
- Fully isolated TRIAC Circuit for AC output with Zero Crossing Detector

User Code and Application Debugging

- On-board debugger for high-quality source code debugging (TK interface)
- User circuit breadboard area (located underneath E Ink unit)

Renesas Online

Each RDK has a dedicated website for additional information and software download.

- www.renesas.com/rdkrl78G14

The Renesas RDK online experience is complemented by the online Renesas ecosystem.

- Renesas Interactive: www.RenesasInteractive.com
    - Free Online Learning
- Renesas Rulz: www.RenesasRulz.com
    - Online community
    - Online user forums
    - http://www.renesasrulz.com/community/demoboards/rdkrl78g14 - Online support site for this RDK
- University Program: www.RenesasUniversity.com
    - Support for Professors and Students
    - Support for University Kits (QSKs)
- Renesas Microcontroller Samples (America Customers)
    - Free of charge
    - Request directly from www.America.Renesas.com/samples

Develop and submit your sample programs to demonstrate these features to the online community: www.RenesasRulz.com/community/renesas_products/rl78

Chapter 3.Power Supply

3.1. Requirements

This RDK gets its power from the debugger mini USB connection or optionally from a regulated 5V power supply. The power jack is a center positive connector using a 2.1 mm barrel. An optional alternate power header is located next to the power jack (J5). Power can also be provided with Connector J14 (application header).

Please watch to supply enough current to this kit, 500mA is recommended, especially when a lot of Wi-Fi communications are ongoing, the new Wi-Fi module can take up to 150mA itself, when having high loads.

If a USB cable is used to provide Power, use preferably short cables and with low impedance from the power source (5V/GND), if you notice coupling between Wi-Fi transmission and flickering in the displays or LEDs, that could mean that your power source is not strong enough.

The RDK PCB is also be loaded with a 3.3V 0.08F super cap (C72), part number XH414HG, which offer battery backup options for the Wi-Fi module.

Warning: The RDK is neither under nor over-voltage protected. To prevent damage, use a 5V REGULATED center positive supply

3.2. Power–Up Behavior

The RL78G14 RDK is booting as a Wi-Fi network server or as a Wi-Fi client node. The Factory demo is divided in 4 operation modes, based on the reset switch and the 3 User push-button configurations at the time of power-up.

Here is a summary of these 4 factory boot modes:

- Limited Access Point with integrated Web Server
- Instant-on Exosite portal client, over Wi-Fi
- User-friendly Wi-Fi provisioning with auto-scanning capability with web interface
- User-friendly Over-the-Air upgrade utility with web interface

For more information about setting up and demoing these modes, please refer to the Renesas, Gainspan and Exosite quick-start guides included inside the insert of your RDK.

Chapter 4. Board Layout

4.1. Component Layout

The following view shows the top layer component layout and placement

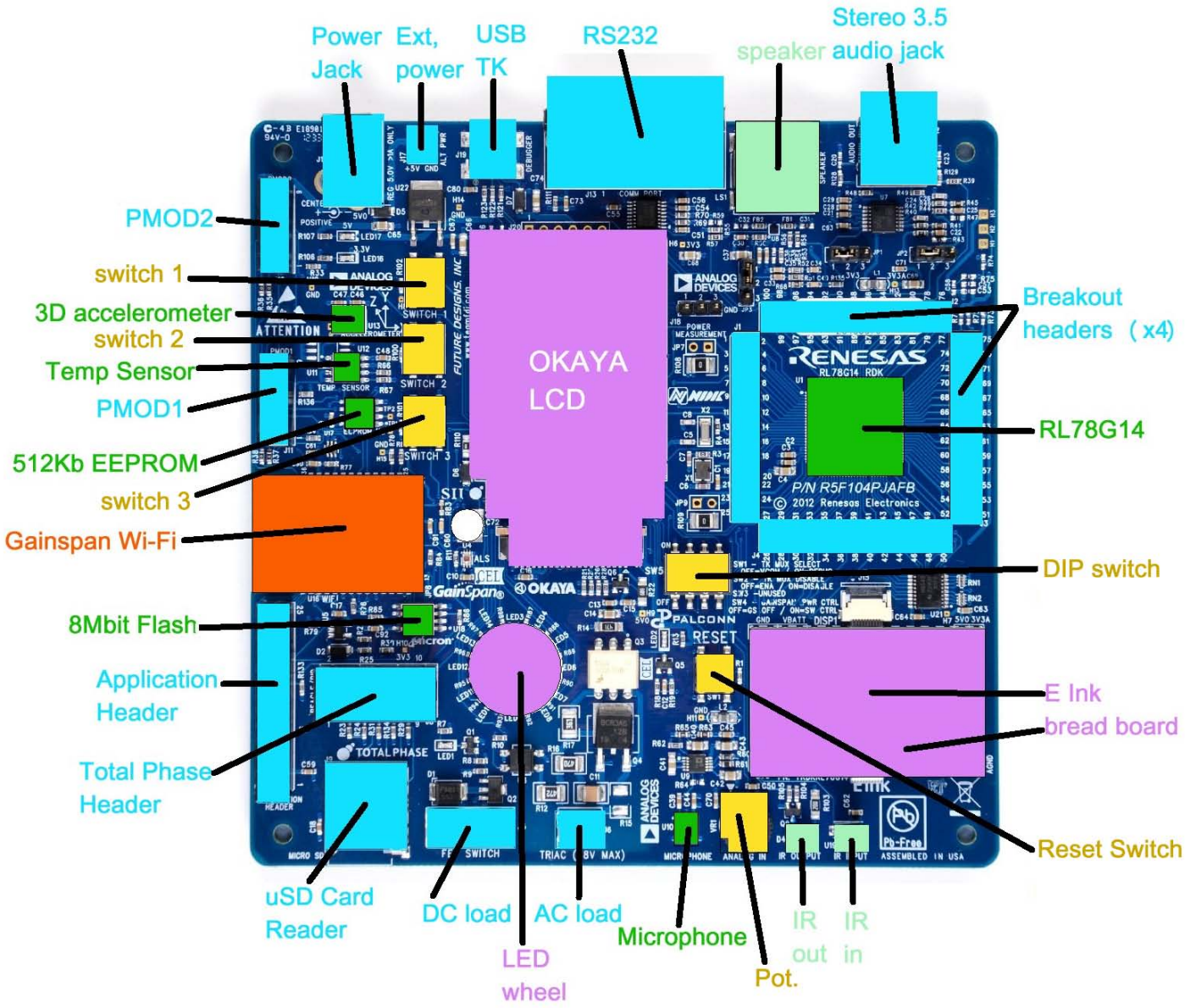


Figure 4-1: Board Layout

4.2. Board Dimensions

The following diagram gives the board dimensions (5.1”x5.1”) and connector locations. All through hole connectors are on a common 0.1” grid for easy interfacing.

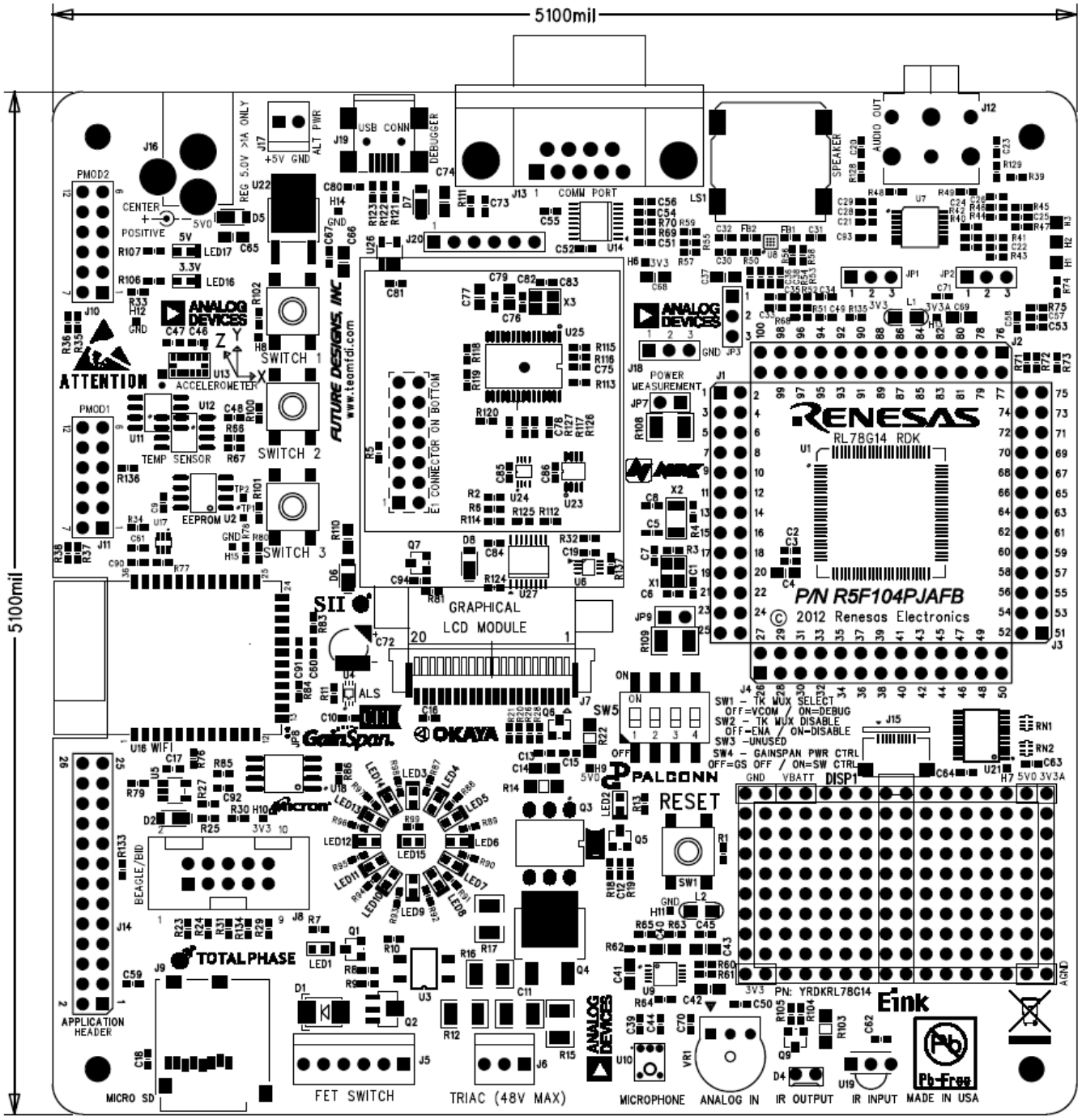


Figure 4-2: Board Dimensions

Chapter 5. Block Diagram

Figure 5-1 shows the CPU board components and their connectivity.

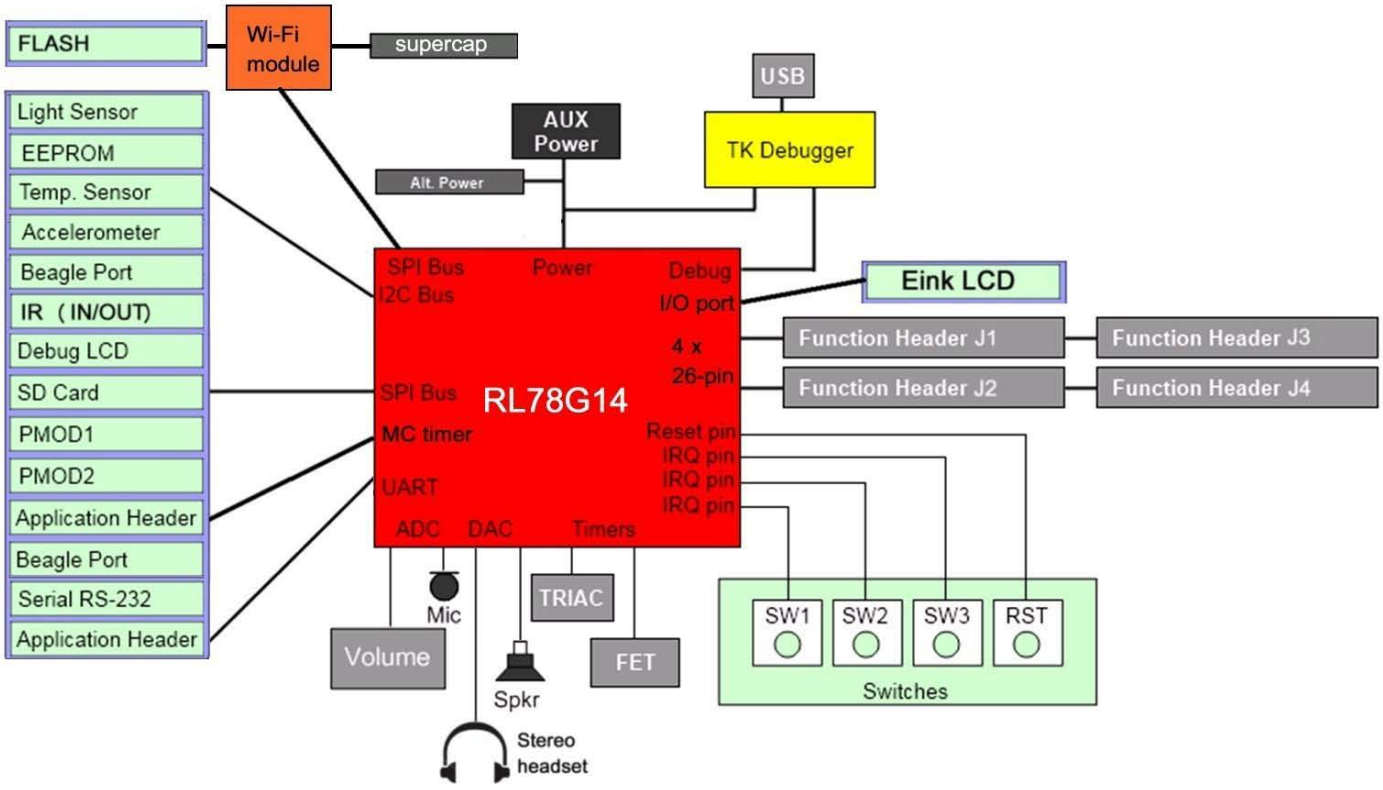


Figure 5-1: Block Diagram

Figure 5-2 shows host PC connection to the RDK board.

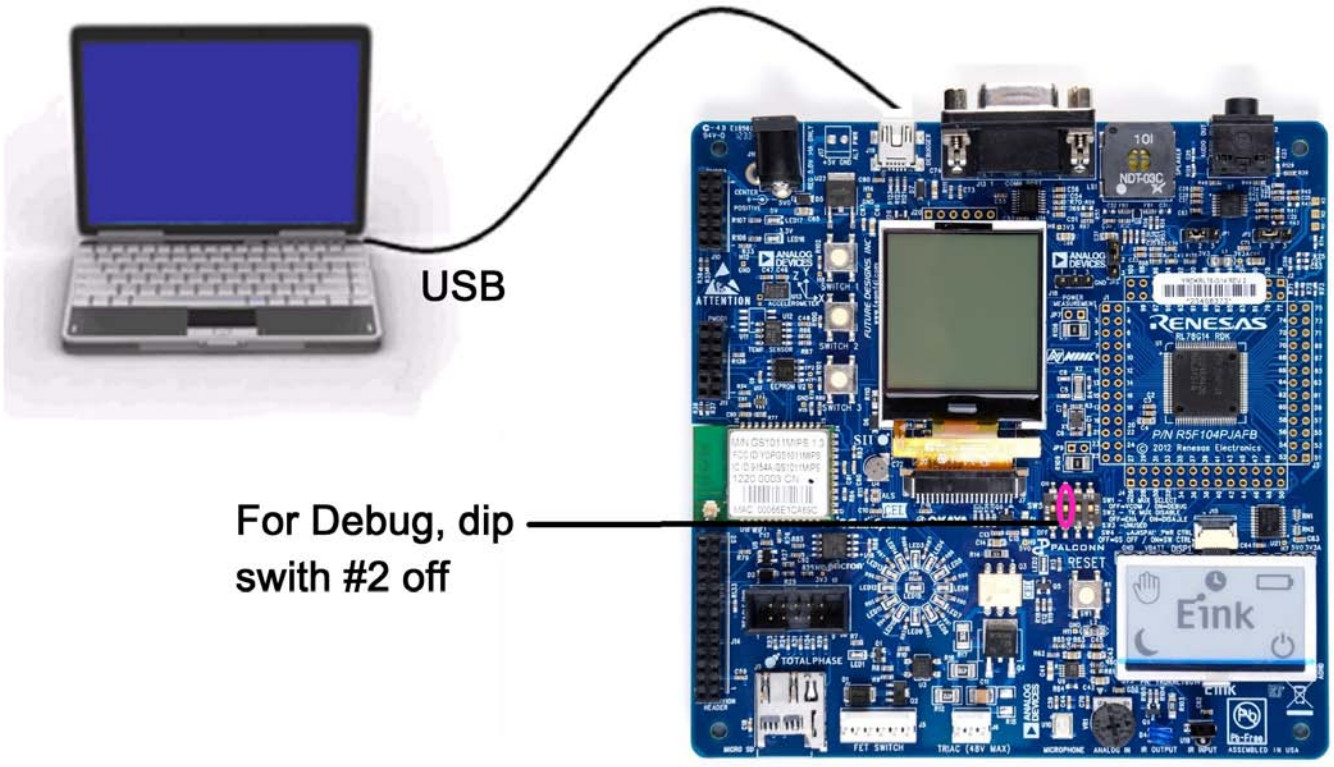


Figure 5-2: RDK Connections

Chapter 6. User Circuitry

6.1. Switches

There are four switches located on the RDK board. The function of each switch and its connection are shown in Table 6-1.

Switch	Function	RL78
SWITCH 1	Connects to an interrupt line for user controls.	INTP10, P76 (pin 34)
SWITCH 2	Connects to an interrupt line for user controls.	INTP8, P74 (pin 36)
SWITCH 3	Connects to an interrupt line for user controls.	INTP9, P75 (pin 35)
RESET	When pressed, the RL78 is reset.	/RESET , (pin 13)

Table 6-1: Switch Functions

6.2.Debug LCD Module

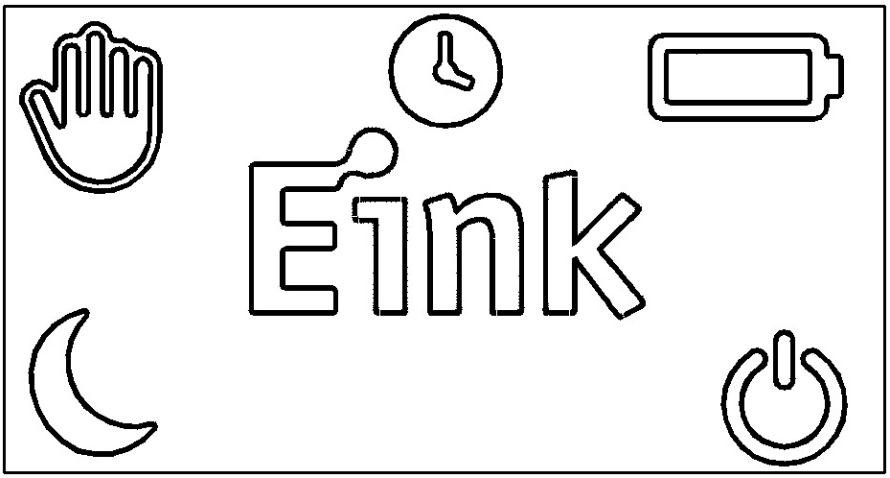
A debug LCD module is supplied on the RDK. The debug LCD module uses an SPI interface to reduce the pin allocation. Software contrast control is also provided. The module supplied with the RDK uses 3.3v. The display is a 96 x 64 graphics display and uses a white LED backlight. The backlight is ON by DEFAULT and can be toggled OFF by setting P00 (BL-ENA, pin 97) LOW. Table 6-2 shows the pin allocation and signal names used for the graphics LCD connector.

Pin	Circuit Net Name	RL78	Pin	Circuit Net Name	RL78
1	+5V Backlight Positive Anode	-	2	GND	-
3	GND	-	4	GND	-
5	GND	-	6	LCD-CS	P145 (pin 98)
7	RSTOUT#	P130 (pin 91)	8	LCD-RS	P146 (pin 73)
9	+3.3V	-	10	+3.3V	-
11	SCK	P70 (pin 40)	12	MOSI	P72 (pin 38)
13	MOSI	P72 (pin 38)	14	MOSI	P72 (pin 38)
15	+3.3V	-	16	+3.3V	-
17	+3.3V	-	18	+3.3V	-
19	GND	-	20	+3.3V	-

Table 6-2: Debug LCD Module Connections (J8)

6.3. E Ink Display

The E Ink segmented display is ultra-thin, rugged, and flexible enabling engineers and designers to add high contrast displays to products where power and space limitations have made it impossible to do so before.

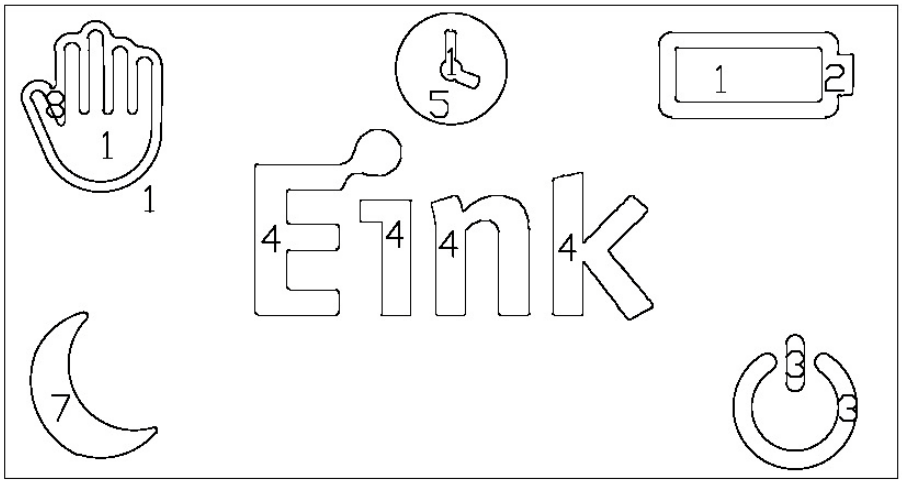


E Ink Display Icons

The E Ink display is driven by inverting level-shifter IC (74AHCT540) connected to several RL78G14 GPIO bits.

Refer to the RDK schematic for specific details on the operation of the E Ink Display interface circuitry or to the E Ink website at: www.eink.com for details on the display technology.

The icon mapping is illustrated in the diagram below and detailed in Table 6-3.



E Ink Display Icon Mapping

Icon	Description	RL78G14 Pin	RL78G14 Port
1	Field (Background)	45	P81
2	Battery	50	P86
3	'PWR' Indicator	51	P87
4	E Ink Logo	44	P80
5	Clock	74	P147
6	Unused	N/A	N/A
7	Sleep Mode (Moon)	78	P154
8	Stop (Hand)	79	P153
N/A	Top Plane	67	P12

Table 6-3: E Ink Display Icon Mapping

WARNING : E Ink displays need to receive calibrated timings, do not drive these I/O lines listed above to exercise this display manually but instead compile approved E ink driver libraries. Failure to apply the proper timing diagrams to these I/Os could end up in electrical damages to this LCD unit !!

E Ink LCD drivers can be found on the main RDK website, download section (www.renesas.com/RDKRL78G14).

6.4. LEDs

There are seventeen LEDs on the RL78 RDK board. The green 5V (LED17) and 3V (LED16) LEDs are ON automatically when the board is powered. There are thirteen user LEDs (see table 6-3) that are connected to IO ports and will light when their corresponding port pin is set low. Table 6-4, below, shows the LED functions and for the user LEDs, pin references and their corresponding microcontroller port pin connections.

Circuit Net Name	Function	Color	RL78
LED1 (FET-PWM)	User Controlled / FET Activity	Green	P11 (pin 68)
LED2 (TRIAC-PWM)	User Control / TRIAC Activity	Green	P10 (pin 69)
LED3 (RLED1)	User Controlled	Red	P62 (pin 26)
LED4 (GLED1)	User Controlled	Green	P42 (pin 10)
LED5 (RLED2)	User Controlled	Red	P63 (pin 27)
LED6 (GLED2)	User Controlled	Green	P43 (pin 9)
LED7 (RLED3)	User Controlled	Red	P64 (pin 29)
LED8 (GLED3)	User Controlled	Green	P44 (pin 8)
LED9 (RLED4)	User Controlled	Red	P65 (pin 30)
LED10 (GLED4)	User Controlled	Green	P45 (pin 7)
LED11 (RLED5)	User Controlled	Red	P66 (pin 31)
LED12 (GLED5)	User Controlled	Green	P152 (pin 80)
LED13 (RLED6)	User Controlled	Red	P67 (pin 32)
LED14 (GLED6)	User Controlled	Green	P101 (pin 70)
LED15	User Controlled	Orange	P41 (pin 11)
LED16	3.3V	Green	N/A
LED17	5V	Green	N/A

Table 6-4: LEDs

6.5. GainSpan Wi-Fi Module (U16)

The GainSpan Wi-Fi module utilizes either serial UART or SPI interfaces, enabling connection to any embedded design utilizing a 8/16/32-bit microcontroller via simple commands. The GS1011M is an ideal solution for users with limited or no Wi-Fi or RF expertise, as it not only dramatically reduces RF design time but also removes the burden of testing and certification, allowing customers to focus on their core application, product or expertise. The module supports data rates up to 11 Mbps, is compliant with 802.11b and meets regulatory and Wi-Fi Alliance requirements.

The GainSpan module is connected to a dedicated Wi-Fi-only SPI interface and optionally the UART3 of the RL78G14.

Note that dip switch (SW5) position 4 controls the power enable/disable of the GainSpan Wi-Fi module. Refer to Section 7 for details on the switch function.

Refer to the GainSpan website (www.gainspan.com) for specific details on the function of the module and the datasheet.

Pin	Circuit Net Name	RL78	Pin	Circuit Net Name	RL78
1	Ground	-	19	Ground	-
2	WIFI-SPI-IRQ (GPIO28)	INTP11 (pin 33)	20	Switched 3.3V (VDDIO)	-
3	N/C (GPIO31)	-	21	WI-FI NOTIFY (GPIO19)	P120 (pin 4)
4	N/C (ADC1)	-	22	WIFI-PWMOUT (PWMO)	P151 (pin 81)
5	WIFI-SPI-MOSI	SO31 (pin 56)	23	N/C (GPIO9)	-
6	WIFI-SPI-CS	P55 (pin 59)	24	N/C (GPIO8)	-
7	WIFI-SPI-CLK	SCK31 (pin 58)	25	WIFI-MODE (GPIO26)	P56 (pin 60)
8	WIFI-SPI-MISO	SI31 (pin 57)	26	WIFI-PGM (GPIO27)	P57 (pin 61)
9	WIFI-WAKE	P73 (pin 37)	27	N/C (GPIO3)	-
10	VBAT	-	28	N/C (GPIO2)	-
11	N/C (ALARM2)	-	29	WIFI-RXD (UART0_TX)	RXD3 (pin100)
12	Power Ctrl (DC-DC-CTRL)	-	30	WIFI-TXD (UART0_RX)	TXD3 (pin99)
13	N/C (GPIO21)	-	31	N/C (GPIO24)	-
14	MSPI-CS (EEPROM)	-	32	N/C (GPIO25)	-
15	MSPI-CLK (EEPROM)	-	33	RSTOUTn (EXT_RESETn)	P130 (pin 90)
16	N/C (EEPROM)	-	34	N/C (1V8)	-
17	MSPI-DIN (EEPROM)	-	35	WIFIVIN (VIN_3V3)	-
18	MSPI-DOUT (EEPROM)	-	36	Ground	-

Table 6-5: GainSpan Module Connections (U16)

6.6. Serial EPROM (U2)

A Renesas serial EPROM is provided for user non-volatile storage. This part, R1EX24512ASAAS0A, is 512Kb and is accessed by the I2C Bus (IICA0) with the following address with 17 bits:

```
I2C Address: 0xA0 (1010aaxr)      aa = A2:A1 I2C address
                                  x = A16 of memory address
                                  r = R/W, Read/Write.
```

6.7. MicroSD Memory Card Slot (J9)

A MicroSD memory card slot is provided for file system data storage. This is accessed on the SPI bus (CSI10) using chip select P142 (pin 1) on the RL78.

6.8. Audio (Audio Out, Mic, Speaker, Volume Potentiometer)

An amplified stereo headphone audio output jack is provided and connected to the timer circuit. TO02 is used for Right audio channel and comes out on RL78 pin 62. TO01 is used for the Left audio channel and comes out on RL78 pin 63. The headphone amp (U7) is an ON Semi NCP2811 and may be disabled by setting P04 (pin 93) low. The on-board speaker is powered by a SCM2377 (U8) audio power amplifier with gain control via P102 (pin 92) and can be disabled by setting P06 (pin 41) low. An on-board Analog Devices Inc. (ADI) Silicon microphone ADMP401 (U10) is connected to the ADC channel ANI5 (pin 25) using an ADI SSM2167 (U9) low voltage Microphone preamplifier that may be disabled by setting P05 (pin 42) low.

6.9. Serial port (U14/J13)

The Serial module allows the MCU to communicate to a Host PC through the RS-232 connector, J13, using UART1 on the RL78. The serial port is configured in DCE mode allowing direct connection to a PC without a Null modem. The serial module can also be used as a serial debug port. Table 6-6 contains details of the specific pin functions and their locations.

Description	Function	MCU Pin	Connector Pin
TxD1	Serial Transmission Pin	95	J14.2
RxD1	Serial Reception Pin	94	J14.3

Table 6-6: Serial port pin details

6.10. 3-Axis Accelerometer (U13)

The RDK includes an Analog Devices ADXL345 3–axis accelerometer. The part is accessed by the I2C Bus (IICA0) with the following address:

```
I2C Address: 0x3A (0011101r) where r = R/W
```

6.11. Digital Temp Sensor (U11)

The RDK includes an ADT75 (U11) Digital Temperature Sensor. An optional alternate sensor, ADT7410 (U12), may be utilized. The part is accessed by the I2C Bus (IICA0) with the following address:

```
I2C Address: 0x90 (10010aar) where aa = A1:A0, r = R/Wn
```

6.12. Ambient Light Sensor (U4)

The RDK includes a Renesas Ambient Light Sensor (Part Number: PH5551A2NA1). This part is accessed by the I2C bus (ICA0) with the following address:

```
I2C Address: 0x72 (0111001r) where r = R/Wn
```

6.13. Potentiometer (VR1)

A single turn potentiometer is connected to the ADC channel ANI8 (pin 82) of the microcontroller. This may be used to vary the input analog voltage value to this pin between 3V3A and Ground.

Note: The potentiometer is fitted to offer an easy way of supplying a variable analog input to the controller. It does not necessarily reflect the accuracy of the controllers ADC. Please see the device manual for details.

6.14. Infrared Emitter (D4) & Detector (U19)

An infrared emitter (IR-LED, part TSKS5400S) and infrared detector (IR-DET, part TSOP98238) are included on the RDK. The IR emitter is designed to use the burst capabilities of the RL78 Clock/Buzzer Output (PCLBUZ0) and is output on CPU pin 3. The IR detector can be used with either the TI03 or INTP4 interfaces on the RL78 to detect IR bursts on CPU pin 28.

Note1: These IR emitter and IR detector are positioned close together on the board. The detector will receive the output of the emitter.

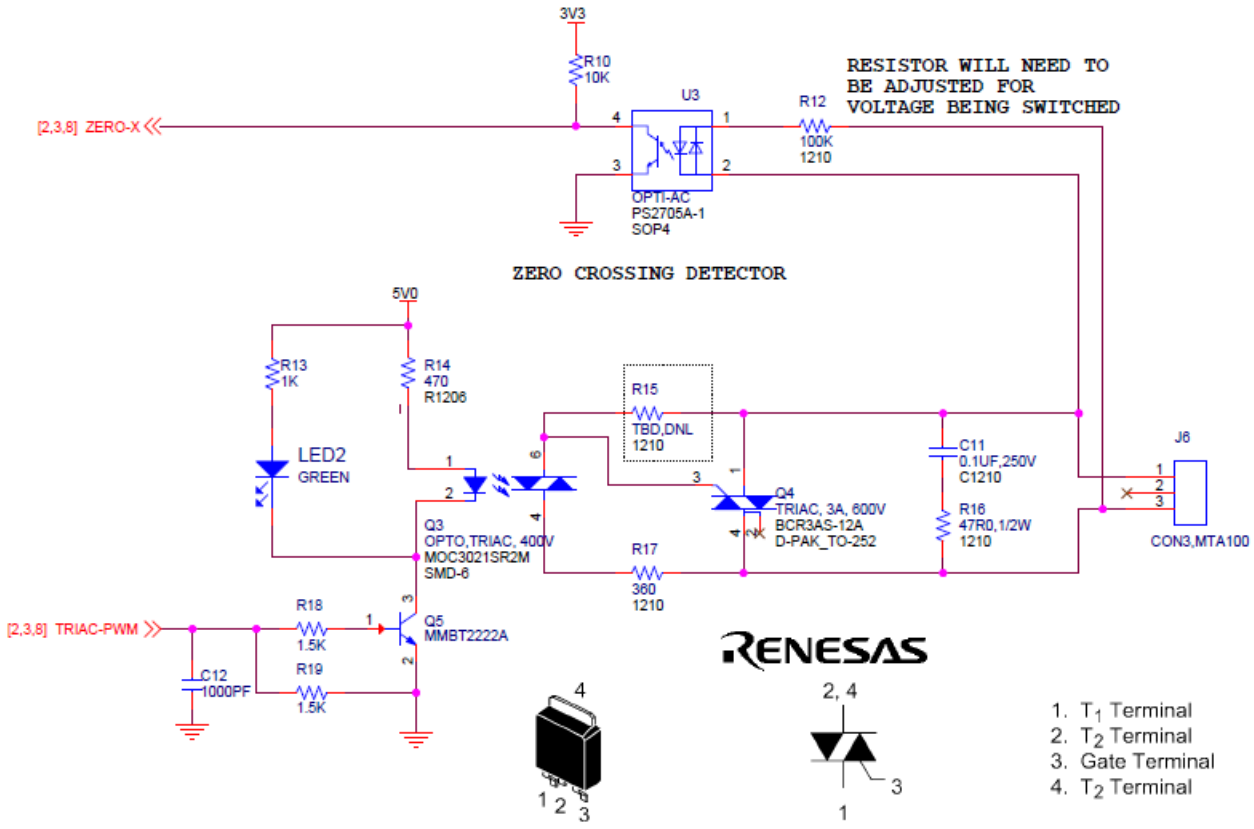
Note2: These IR interfaces are designed to operate in a given range of carrier frequencies. Typically it is between 30kHz and 50kHz.

6.15. TRIAC (Q3) & Zero Crossing Detector (U3)

A Renesas Triac, Part number: BCR3AS-12A, designed for low power use is included on the RDK. The Triac can be turned ON by an I/O pin of the CPU to control an AC load. The Triac connections are to be in series with a low-voltage AC source (48VAC RMS Maximum) and a load at J3 between 1 &3, as shown in the schematic below. It can turn the

load ON and OFF but is not intended for dimming or proportional (phase) control. When the RL78 pin 69 is set to HIGH, the transistor Q6 is turned on, which turns on the input of the opto-coupler. The opto-coupler output allows current to flow to the Gate of Q2. Resistor R10, 360 ohm, limits current to the Triac Gate. When the load is turned ON, as RL78 Pin 69 is set to HIGH, LED2 will turn on at the same time.

A Zero Crossing detector circuit is available for applications that require switching the TRIAC only during zero crossing events. This signal, 'ZERO-X' is present on INTP0, RL78 pin 16.

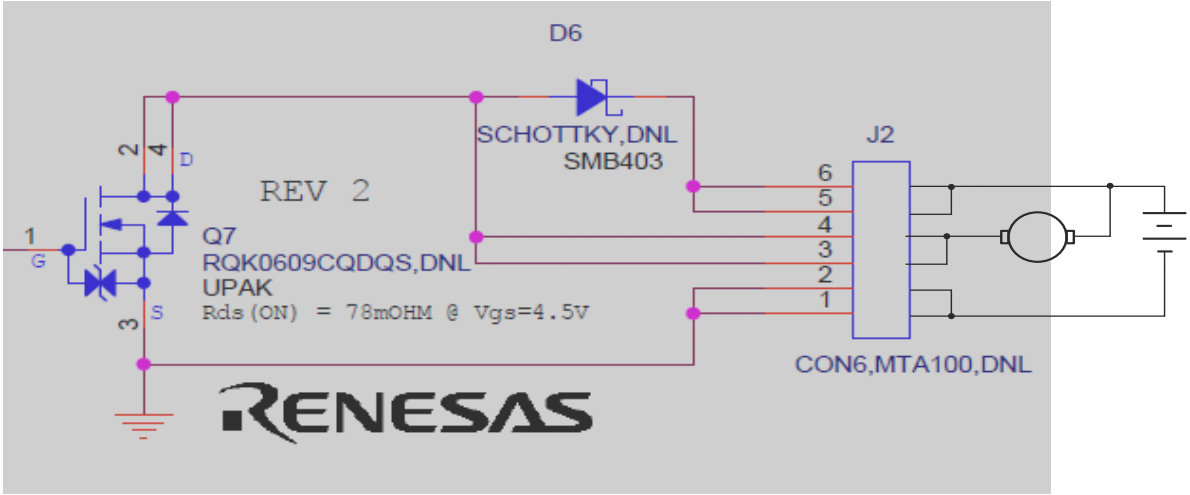


Note: DO NOT USE LINE VOLTAGE! For safety, an isolation transformer is required.

6.16.FET (Q2)

A Renesas N-channel power switching MOSFET (part number: RQKD609CQDQS) Q7 with low on resistance (Rds(ON) = 78mOHM typ.) is included on the RDK. The MOSFET will switch a load (ON/OFF) connected between header J5-5&6 and J5-3&4. The power to the MOSFET is supplied from external source from header J5-1&2 (ground or negative) to J5-5&6 (positive, up to 60V max). The MOSFET will switch the load ON or OFF by PWM waveform output from the RL78 timer channel TRDIOD1 on CPU pin 68. LED1 will Turn ON when the MOSFET is ON.

A schottky flywheel diode which matches with the MOSFET ratings (2A at 60V) is added to catch flyback currents when using inductive loads such as small motors. The below is an example of connection diagram when external motor or lamp is connected to the MOSFET. Using PWM can vary the motor speed.



6.17. Oscillator Sources

All crystals are provided by NDK. The RDK supplies the RL78 with an external main system clock crystal unit (X1), part number NX3225GA, and subsystem clock crystal unit (X2), part number NX3215SA. The TK debugger has a USB clock crystal unit (X3), part number NX3225SA. Table 6-7 details the crystals that are fitted on the RL78 RDK.

Component	Function	Frequency
Crystal (X1)	Main System Clock (X1)	12 MHz
Crystal (X2)	Subsystem Clock (XT1)	32.768 KHz
Crystal (X3)	Debugger USB Clock	16 MHz

Table 6-7: Oscillators / Resonators

6.18. Reset Circuit

The RDK includes a user reset pushbutton switch (SW1) which is connected to the internal reset circuit on the RL78 (RESET#) and reset output from the TK Debugger (T-RESETn).

There is a peripheral reset control line connected to P130 (pin 91) on the RL78 which can be used to reset major peripherals at once. This includes the Wi-Fi, Beagle Port, Application Header, and Debug LCD.

6.19. Total Phase Beagle Debug Header (J8)

The Beagle I2C/SPI Protocol Analyzer is a non-intrusive USB-based bus monitor that can capture, display, and filter I2C and SPI data as it appears on the bus. Using both the Data Center Software and Beagle analyzer, users can easily view

I2C bus traffic (up to 4 MHz) and SPI bus traffic (up to 24 MHz) in real time. Additional functionality allows engineers to filter data against a wide variety of parameters, or instantly search for specific hexadecimal or ASCII data patterns during a live capture. The Beagle analyzer is fully supported on Windows, Linux, and Mac OS X, and comes with free software, free APIs, free technical support, and free software/firmware upgrades.

Total Phase manufactures powerful and affordable USB, I2C, SPI, and CAN tools for embedded systems engineers. The complete line of Total Phase host adapters and protocol analyzers are the development and debugging tools of choice for Fortune 500 companies, small businesses, and research institutions all over the world.

For more technical information, online demos, and ordering information, visit www.totalphase.com.

Chapter 7. Mode Switch

This RDK has an on-board module with 4 switches (SW5) for controlling TK MUX Select, TK MUX Disable, and GainSpan Wi-Fi Module Power Enable. Table 7-1 below shows common settings for SW5.

Mode	TK MUX Select	TK MUX Disable
Run	ON	ON
Debug	ON	OFF
Virtual COM	OFF	OFF

Table 7-1: Common Mode Configurations

TK MUX Select (SW5.1)

- ON sets the USB connection (J16) for debugging purposes.
- OFF sets the USB connection (J16) as a virtual communication port.

TK MUX Disable (SW5.2)

- ON disables the TK debugger and puts the RL78 in normal operation.
- OFF enables the TK debugger and puts the RL78 in debug operation.

SW5.3 is not used.

GainSpan Wi-Fi Power Enable/Disable (SW5.4)

- ON Enables software control over the GainSpan power
- OFF Disables the GainSpan power completely

Chapter 8.Programming Methods

The RDK is intended for use with IAR EWB, Renesas HEW and Renesas e^{2}studio and includes an integrated Renesas TK debugger. Refer to RL78 Family Hardware Manual for details of programming the microcontroller without using these tools. The on-board TK debugger is pre-programmed at the factory and configured for normal operation. Should the TK debugger become non-responsive, please check the position of the DIP switch #2 that should be in the OFF position.

Also a new connector footprint was added on the bottom-side of the board, to support alternately E1 type emulator (check Chapter.10 for more details)

Note: SW5 must be set to debug mode to program the RL78. Please refer to the Mode Switch chapter for how to configure the RDK for programming.

Chapter 9. Headers

9.1. PMOD™ Interfaces

Two Digilent PMOD™ (Interface Type 2A, expanded SPI) connection headers are available on the RDK. These interfaces utilize separate SPI busses and can be accessed using chip selects P82 (pin 46) for PMOD1 and P83 (pin 47) for PMOD2. PMOD™ Interface connections are shown in Table 9-1.

			PMOD1		PMOD2	
Pin	Signal	Direction	Circuit Name	RL78	Circuit Name	RL78
1	SS	Out	PMOD1-CS	P82 (pin 46)	PMOD2-CS	P83 (pin 47)
2	MOSI	Out	PMOD1-MOSI	SO20 (pin 66)	MOSI	SO21 (pin 38)
3	MISO	In	PMOD1-MISO	SI20 (pin 65)	MISO	SI21 (pin 39)
4	SCK	Out	PMOD1-SCK	SCK20 (pin 64)	SCK	SCK21 (pin 40)
5	GND	-	Ground	-	Ground	-
6	VCC	-	3V3	-	3V3	-
7	INT	In	PMOD-IRQA	P46, INTP1 (pin 6)	PMOD-IRQB	P47, INTP2 (pin 5)
8	RESET/INT	Out	PMOD-IRQB	P47, INTP2 (pin 5)	PMOD-IRQA	P46, INTP1 (pin 6)
9	N/S	N/S	PMOD_PIN9	P110 (pin 71)	PMOD_PIN9	P110 (pin 71)
10	N/S	N/S	PMOD_PIN10	P111 (pin 72)	PMOD_PIN10	P111 (pin 72)
11	GND	-	Ground	-	Ground	-
12	VCC	-	3V3	-	3V3	-

Table 9-1: PMOD™ Interfaces

9.2. Application Header

The application header J14 can be fitted with a WIFI module or other optional IO module like a Motor Control adapter. These devices can be accessed UART2 or the SPI bus (CSI10) using chip select P73 (pin 26) on the RL78. WIFI interrupt requests can be received on INTP8 (pin 25) on the RL78. As of November 2011, several Wi-Fi modules were available and some units released for RL78 by Gainspan Corp. and RedPine Signals were qualified, more information at :

- http://www.gainspan.com/
- http://www.redpinesignals.com/

J17 Pin	MCU Pin	RDK Function (MCU Port)	J17 Pin	MCU Pin	RDK Function (MCU Port)
1	-	5V	2	-	Ground
3	-	3.3V	4	-	Ground
5	65	GPIO (P14)	6	69	GPIO (P10)
7	64	GPIO (P15)	8	68	GPIO (P11)
9	63	GPIO (P16)	10	67	GPIO (P12)
11	62	GPIO (P17)	12	66	GPIO (P13)
13	79	GPIO (P153)	14	16	GPIO (P137)
15	48	APP-WIFI-CS (P84)	16	91	RSTOUT# (P130, inverted by U6)
17	49	APP-WIFI-PWROFF (P85)	18	78	GPIO (P154)
19	38	MOSI (P72/SO21)	20	40	SCK (P70/SCK21)
21	55	LIN-TXD (P51/TXD0)	22	39	MISO (P71/SI21)
23	52	APP-WIFI-IRQ (P30/INTP3)	24	54	LIN-RXD (P50/RXD0)
25	77	APP-WIFI-GPIO25 (P155)	26	76	APP-WIFI-GPIO26 (P156)

Table 9-2: Application Header

9.3.Expansion Headers (J1-J4)

Table 9-3 through Table 9-4 show the controller pin headers and their corresponding microcontroller connections. The header pins connect directly to the MCU pin. Note that the J1-J4 header numbers match the MCU pin numbers.

J1 Pin	MCU Pin	RDK Function (MCU Port)	J1 Pin	MCU Pin	RDK Function (MCU Port)
1	1	SD-CS (P142)	2	2	ALS-IRQ (P141)
3	3	IR-OUTPUT (P140)	4	4	Unused (P120)
5	5	PMOD-IRQB (P47)	6	6	PMOD-IRQA (P46)
7	7	GLED4 (P45)	8	8	GLED3 (P44)
9	9	GLED2 (P43)	10	10	GLED1 (P42)
11	11	ORLED (P410	12	12	TK TOOL0 (P40)
13	13	RESETn input to RL78	14	14	32.768KHz XTAL2 (P124)
15	15	32.768KHz XTAL1 (P123)	16	16	ZERO-X (P137)
17	17	12MHz XTAL2 (P122)	18	18	12MHz XTAL1 (P121)
19	19	REGC	20	20	Ground
21	21	Ground	22	22	3.3V
23	23	3.3V	24	24	(P60)
25	25	(P61)			

Table 9-3: J1 Expansion Header

J4 Pin	MCU Pin	RDK Function (MCU Port)	J4 Pin	MCU Pin	RDK Function (MCU Port)
26	26	RLED1 (P62)	27	27	RLED2 (P63)
28	28	IR-INPUT (P31)	29	29	RLED3 (P64)
30	30	RLED4 (P65)	31	31	RLED5 (P66)
32	32	RLED6 (P67)	33	33	WIFI-SPI-IRQ (P77)
34	34	SWITCH1 (P76)	35	35	SWITCH3 (P75)
36	36	SWITCH2 (P74)	37	37	WIFI-WAKE (P73)
38	38	MOSI (P72)	39	39	MISO (P71)
40	40	SCK (P70)	41	41	SPK-SHDNn (P06)
42	42	AMP-SHDNn (P05)	43	43	Ground
44	44	EINK-CS# (P80)	45	45	EINK-TP-HIGH# (P81)
46	46	PMOD1-CS (P82)	47	47	PMOD2-CS (P83)
48	48	APP-WIFI-CS (P84)	49	49	APP-WIFI-PWROFF (P85)
50	50	EINK-CLR# (P86)			

Table 9-4: J4 Expansion Header

J1 Pin	MCU Pin	RDK Function (MCU Port)	J1 Pin	MCU Pin	RDK Function (MCU Port)
51	51	Unused (P87)	52	52	APP-WIFI-IRQ (P30)
53	53	3.3V	54	54	LIN-RXD (P50)
55	55	LIN-TXD (P51)	56	56	WIFI-SPI-MOSI (P52)
57	57	WIFI-SPI-MISO (P53)	58	58	WIFI-SPI-CLK (P54)
59	59	WIFI-SPI-CS (P55)	60	60	WIFI-MODE (P56)
61	61	WIFI-PGM (P57)	62	62	PWMAUD-R (P17)
63	63	PWMAUD-L (P16)	64	64	PMOD1-SCK (P15)
65	65	PMOD1-MISO (P14)	66	66	PMOD1-MOSI (P13)
67	67	Unused (P12)	68	68	FET-PWM (P11)
69	69	TRIAC-PWM (P10)	70	70	GLED6 (P101)
71	71	PMOD-PIN9 (P110)	72	72	PMOD-PIN10 (P111)
73	73	LCD-RS (P146)	74	74	Unused (P147)
75	75	LINNSLP (P100)			

Table 9-5: J3 Expansion Header

J2 Pin	MCU Pin	RDK Function (MCU Port)	J2 Pin	MCU Pin	RDK Function (MCU Port)
76	76	APP-WIFI-GPIO26 (P156)	77	77	APP-WIFI-GPIO25 (P155)
78	78	Unused (P154)	79	79	Unused (P153)
80	80	GLED5 (P152)	81	81	WIFI-PWMOUT (P151)
82	82	VRES (P150)	83	83	PWMLP-IN (P27)
84	84	AUD-R-FB (P26)	85	85	MIC-INPUT (P25)
86	86	Unused (P24)	87	87	DACAUD-R (P23)
88	88	DACAUD-L (P22)	89	89	Unused (P21)
90	90	Unused (P20)	91	91	EXTRST (P130)
92	92	SPK-GAIN (P102)	93	93	HEADPH-SDn (P04)
94	94	DB9-RXD (P03)	95	95	DB9-TXD (P02)
96	96	PWMLP-OUT (P01)	97	97	BL-ENA (P00)
98	98	LCD-CS (P145)	99	99	WIFI-TXD (P144)
100	100	WIFI-RXD (P143)			

Table 9-6: J2 Expansion Header

Chapter 10.Code Development

10.1. Overview

Note: For all code debugging using RL78 IAR software tools, the CPU board must be connected to a PC USB port via the on-board TK interface and debugger. It is also possible to connect an E1 type emulator, a connector footprint was made available on the bottom side of the board, underneath the debug LCD.

You may need to lift up this display, during the installation of such connector for the E1 interface. The bottom silkscreen shows the polarity of the connector for E1 debugger.

Due to the continuous process of improvements undertaken by Renesas and IAR, the user is recommended to review the information provided on the Renesas website at http://www.renesas.com/RDKRL78G14 to check for the latest tool updates and manuals.

10.2. Memory Map

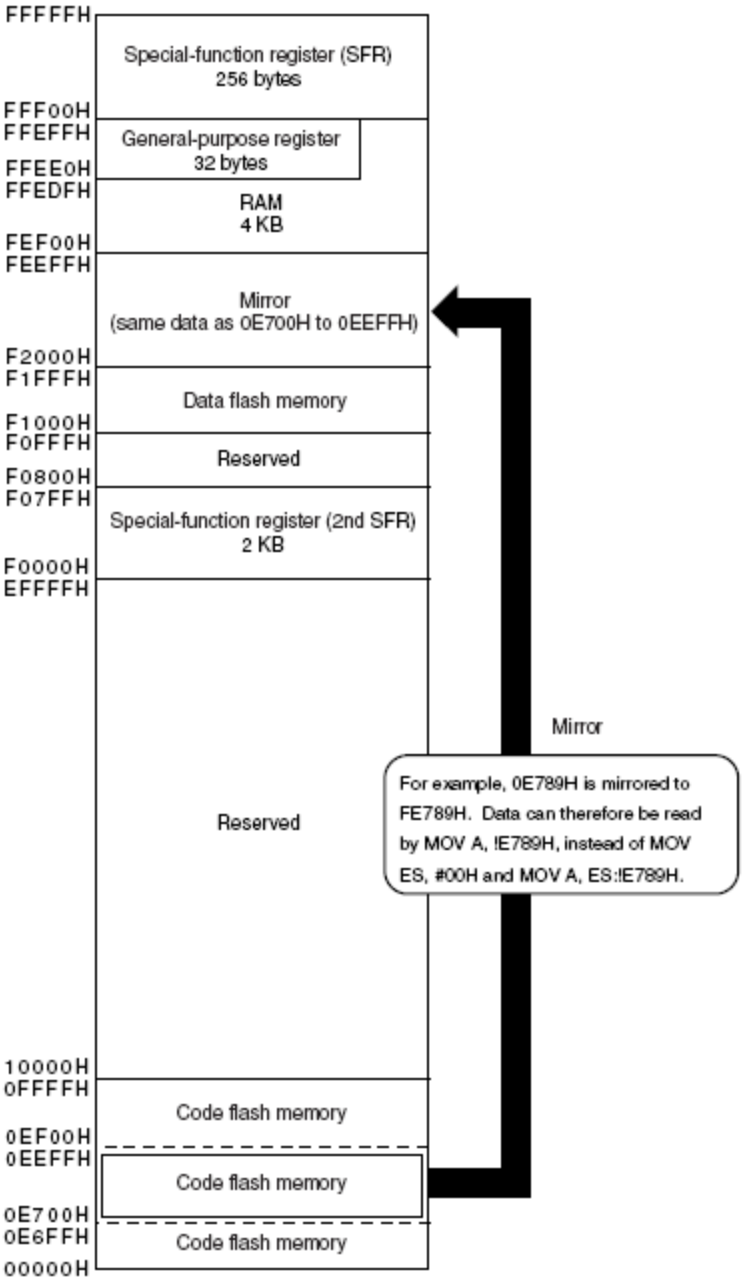


Table 10-1: Memory Map

Chapter 11. Component Placement

11.1.Hardware Partner Information

Hardware partners played an integral role in the definition, development, and deployment of this RDK. Without their numerous contributions, this project would not have been possible. Contributors include: Analog Devices supplied the ADXL345 3-Axis Accelerometer, SSM2167 microphone preamplifier and ADMP401 digital microphone as well as the ADT7410 temp sensor and ADM3101E RS-232 line driver / receiver. NDK contributed all 3 crystals for the board. Okaya provided the 96 x 64 backlit graphics LCD. E Ink provided the segmented electronic ink Display. Total Phase provided the connectors to interface to their beagle serial channel debugger, Seiko Instruments the Super Cap for the Wi-fi module, Micron the Flash memory, Gainspan the Wi-Fi module, On Semi the audio amplifier, CEL the optical couplers . And finally, Future Designs, Inc. provided the hardware customization, schematic capture, PCB design and layout, manufacturing, and Supply Chain Management services for this RDK. For more information or to contact our partners please refer to their websites:

- Analog Devices – http://www.analog.com
- Total Phase – http://www.totalphase.com
- Okaya – http://www.okaya.com
- NDK - http://www.ndk.com/en/
- Future Designs Inc. – http://www.teamfdi.com
- E Ink Display - http://www.eink.com
- Seiko Instruments Inc. - www.sii-me.com
- Micron – www.micron.com
- On Semi – www.onsemi.com
- PalConn – www.palpilot.com
- GainSpan - www.gainspan.com
- Exosite – www.exosite.com
- CEL - http://www.cel.com/

ez.analog.com/welcome

Analog Devices, Inc.

Acknowledged industry-wide as the world leader in data conversion and signal conditioning technology, Analog Devices, offers a broad product portfolio to complement Renesas microcontrollers. ADI provides power, analog signal conditioning, data converters, Audio/Video and serial data-transfer solutions to meet the needs of technically demanding applications.

ANALOG DEVICES

Analog Devices, Inc.
Corporate Headquarters
3 Technology Way
Norwood, MA 02062
tel: +1 (781) 329-4700

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Analog Devices Demos Converter, Sensor, MCU Systems

Analog Devices will be presenting and demonstrating interoperability between Renesas MCUs and Analog Devices' A/D converters and sensors. Over 40 Renesas/Analog Devices reference design are available for download at: http://wiki.analog.com/renesas

▶ *Renesas and Analog Devices partnered to create the Audio Demonstration Kit using the RX62N RDK and Analog Devices' SSM2377 Class-D Audio Amplifer.*

ANALOG DEVICES
RENESAS
RX62N/ADI SSM2377
Audio Demonstration Kit
Easily integrate quality sound into low-power, portable applications using the Renesas RX62N MCU and the ADI SSM2377 Class D audio amplifier
Audio

Renesas/Analog Devices reference designs available for download:

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www.totalphase.com

Total Phase, Inc.

Total Phase is a leading provider of embedded systems development tools for engineers all over the world. Total Phase's mission is to create powerful, high-quality, and affordable solutions for the embedded engineer. Products from Total Phase have become tools of choice for a wide array of companies and industries. For years, Total Phase has developed products that have become tools of choice for Fortune 500 companies, small businesses, and research institutions alike.

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Total Phase, Inc.
735 Palomar Ave
Sunnyvale, CA 94085
tel: (408) 850-6500

GOLD PARTNER RENESAS

Industry-Leading Provider of Embedded Tools for USB, I2C, SPI, and CAN

Total Phase strives to bring powerful, low-cost development tools to the embedded engineer. With our affordable, pocket-sized line of protocol analyzers and host adapters, engineers can reduce their development and debugging time.

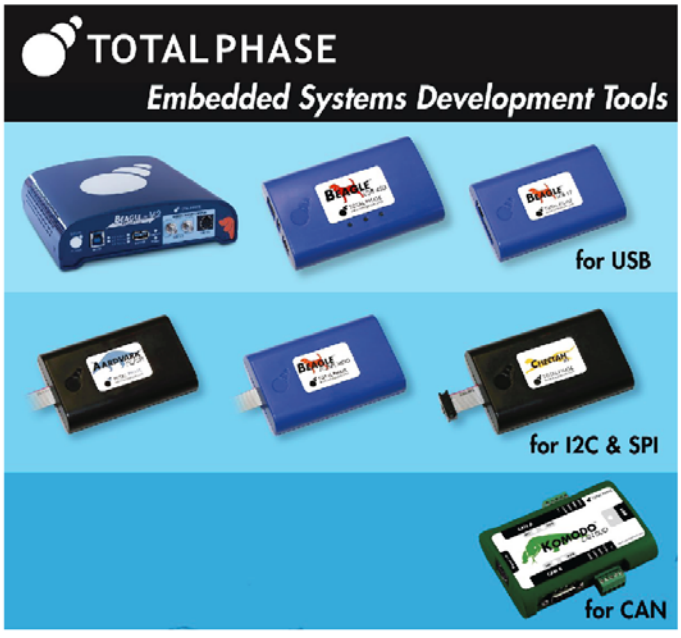
Our line of protocol analyzers features the Beagle USB 5000 v2 SuperSpeed, the Beagle USB 480, the Beagle USB 12, and the Beagle I2C/SPI protocol analyzers. Each analyzer non-intrusively monitors the bus in real time, instantly displaying the streaming data.

The Beagle USB analyzers can be used to monitor traffic between a PC host and various USB peripheral devices such as external hard drives, flash drives, hubs, and mice. The Beagle I2C/SPI analyzer can be used to monitor I2C and SPI buses. For example, the analyzer can non-intrusively examine the traffic coming from a slave I2C accelerometer and SPI thermal senor.

Total Phase's host adapters are the perfect complement to the Beagle I2C/SPI analyzer and can actively send messages on the bus. The Aardvark host adapter is capable of emulating master and slave devices and communicating at speeds up to 800 kHz for I2C and 8 MHz for SPI. For programmers with high-speed SPI needs, the ultra-fast Cheetah SPI host adapter communicates at speeds up to 40+ MHz.

The Komodo CAN Duo Interface is a powerful two-channel USB-to-CAN adapter and analyzer. The Komodo interface is an all-in-one tool capable of active CAN data transmission as well as non-intrusive CAN bus monitoring.

Total Phase prides itself on providing a complete debugging solution. All of our products feature free GUI software, free APIs, free software and firmware upgrades, and free technical support.



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www.okaya.com

Okaya Electric America, Inc.

Okaya Electric America is a global provider of a wide range of LCD modules and display technologies including: Character, Graphic, Color TFT, and OLED display panels. Most of Okaya's standard TFT, Graphic, and OLED display modules are available with Touch Panel technologies. If available standard products do not meet your needs, Okaya also offers extensive options for creating Custom LCD products. These customizations include Sunlight Readability modifications for outdoor applications.

Okaya Electric America, Inc.
52 Marks Road, Suite 1
Valparaiso, IN 46383
1-800-852-0122 (Phone)
1-219-477-4856 (fax)
Sales@okaya.com

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Okaya Custom Glass, Character and Graphic LCD Modules and OLEDs

Character LCD:

8x2, 12x2, 16x1, 16x2, 16x4, 20x2, 20x4, 40x2, 40x4

- OKAYA TN, STN, FSTN, Character Displays are available in 8x2 to 40x4 formats. We offer custom designs for markets including industrial, medical and consumer.

Graphic LCD:

98x32, 100x32, 102x64, 122x32, 128x64,160x32, 240x64, 240x128, 320x240

- OKAYA STN and FSTN Graphic Displays come in a variety of sizes and resolutions and in larger sizes, with touch panels. Selections include a broad spectrum of LCD color combinations, backlights, and industrial polarizers.
- Custom TAB, COB, and COG constructions are available to meet your specifications.

Chip on Glass LCD:

96x64, 128x32, 128x48, 128x64, 240x64, 320x240

- OKAYA COG LCD modules provide resolution sizes from 96x64 to 320x240.
- COG offers high quality, with the benefits of light weight and low power consumption.
- Connection boards can be added to change the interface from FPC to pins or cables

OLED, Character and Graphic:

8x2, 12x2, 16x2, 20x2, 20x4, 50x16, 76x16, 100x16, 100x32, 128x64

- OKAYA single color OLED offers a brighter, higher contrast, color image with a very fast response time. The color saturation coupled with the contrast and low power allows this technology to fit into any market including battery operated consumer products.

TFT:

1.44, 1.77, 2.4, 2.8, 3.0, 3.5, 4.3, 5.0, 5.7, 6.5, 7.0, 8.0, 9.0, 10.4

- OKAYA TFT displays provide high contrast, high bright characteristics and TFT resolution ranges from 128x128 to XGA. TFT modules can be customized with enhancements like ultra-bright 1300 nit backlights and Optically Bonded anti-reflective overlays for sunlight readability.

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■ Model Names of Surface-mount (SMD) Products

Our system for surface-mount (SMD) product model names is as follows:

Configuration of model names of surface-mount products

① Symbol for NDK: N

② Symbols for products: See Table 1.

Table 1 Symbols for products

Product symbol	Product
X	Crystal oscillator
T	Temperature-compensated crystal oscillator (TCXO)
H	Oven-controlled crystal oscillator (OCXO)
V	Voltage-controlled crystal oscillator (VCXO)
P	Simple packaged crystal oscillator (SPXO)
Z	Crystal clock oscillator
M	Monolithic filter
S	SAW device

③④ The nominal length (mm) of a product main body in the longitudinal direction is expressed in two digits. The third digit is rounded off.

⑤⑥ The nominal length (mm) of a product main body in the lateral direction is expressed in two digits. The third digit is rounded off.

Examples: 6.0 mm x 3.5 mm is expressed as 6035.

11.8 mm x 5.5 mm is expressed as 1255.

⑦ Symbols for constituent materials and sealing methods: See Table 2.

Table 2 Symbols for sealing methods

Product sealing category	Symbol	Product sealing method	Package material	
			Base	Cover
Hermetic sealing	C	Adhesive sealing	Ceramics	
	M	Resin molding	Resin	
	P	Adhesive sealing	Resin	
	G	Glass sealing	Ceramics	
	R	Resistance weld sealing	Ceramics	Metal
	S, D	Seam weld sealing	Ceramics	Metal
	A	Au/Sn sealing	Ceramics	Metal
Non-hermetic sealing	W	——	Board	Metal
	X	——	Board	Non-metal
	Y	——	Mold	Metal
	Z	——	Mold	Non-metal
Others	B	A printed board on which multiple crystal elements were mounted with a nameplate attached to its top surface		

⑧ Detailed symbols for the order of model name registration: A to Z

When products designed as lead-mount ones have been converted during secondary processing into surface-mount ones, the product model names given before secondary processing are conventionally used to describe them.

Example: AT-41CD2 (AT-41 with a pedestal)

www.teamfdi.com

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Future Designs, Inc. is a full service design and production company with hardware, software and system level expertise. We offer one stop shopping for our customers and provide "as much" or "as little" help as needed to get your product to market. FDI can take your concept all the way from the back of a napkin, through design and prototypes, to high volume production, branded with your logo and shipped directly to your end customers.

FDI Future Designs, Inc.

Future Designs, Inc.
996 A Cleaner Way SW
Huntsville, AL 35805-6721
tel: 256-883-1240
fax: 256-883-1241

PLATINUM PARTNER RENESAS

Embedded Design and GUI / HMI Touch Screen LCD Solutions

Design/Production Partner

FDI is truly "partnered" with semiconductor suppliers like Renesas Electronics America and with distribution channel partners like Avnet and Digi-Key. We offer hardware, software and system level solutions based on the total line card. One example of this is our uEZ™ GUI Family of integrated solutions for Touch Screen LCD Graphical User Interfaces. uEZ™ GUI provides an "Off The Shelf" solution that allows customers to quickly and cost effectively upgrade their User Interfaces to meet today's market requirements.

We also offer Embedded Hardware and Software Design and Production for a wide variety of customer needs. For customers with their own internal design or production resources, FDI will work hand in hand with your existing team to design and produce a fully integrated custom solution that meets both your schedule and budget requirements.

FDI works closely with Renesas and we have provided the hardware customization, schematic capture and PCB design and layout for several key Renesas projects. In addition, FDI provided full turn-key manufacturing, automated functional test and packaging for the production kits. These include the YRDKRx62N and YRDKRx63N kits in addition to the YRDKRL78G14 kit.

▶ *Our uEZ™ GUI Family provides integrated solutions for Touch Screen LCD Graphical User Interfaces.*

FDI has a proven 23 year history of successful product design and manufacturing. Please give us a call to find out how we can help make your product a success.

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www.eink.com

E Ink Corporation

E Ink Corporation is the creator of electronic ink — the optical component of a proprietary film used in Electronic Paper Displays. Although futuristic in concept, electronic ink is a straightforward fusion of existing knowledge in chemistry, physics and electronics. E Ink displays offer high contrast, superior paper-like readability and low power consumption, drawing power only when switching the display.

E Ink Corporation
733 Concord Avenue
Cambridge, MA 02138
tel: 617.499.6000
info@eink.com

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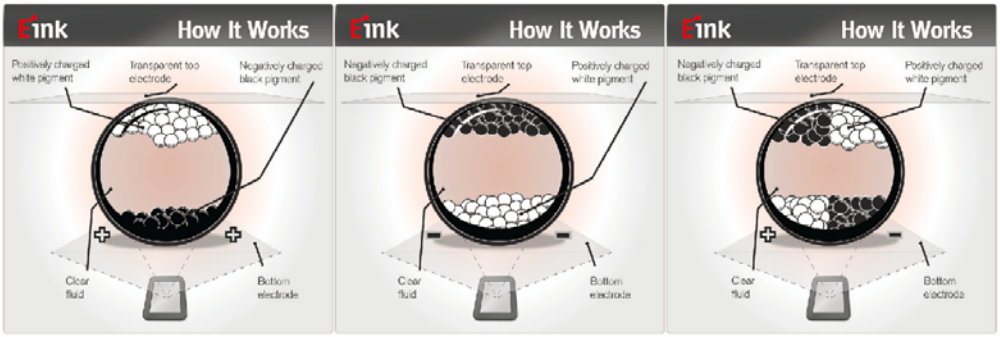
E Ink Segmented Displays are Ultra Low Power, Thin, Rugged, and Flexible

Electronic ink is made up of millions of tiny microcapsules, about the diameter of a human hair. Each microcapsule contains positively charged white particles and negatively charged black particles which are suspended in a clear fluid. When a positive or negative electric field is applied, corresponding particles move to the top of the microcapsule where they become visible to the user.

E Ink's unique reflective display technology is sunlight readable and can display an image with no power. This enables engineers and designers to add displays to products where power and space limitations have made it impossible to do so before. Applications for the technology are broad, including a wide variety of consumer electronics, watches, medical devices, industrial gauges, PC-accessories, smart cards, electronic shelf labels, and mobile communications.



The disruptive benefits of E Ink Segmented displays include:

- **Ultra Low Power** – E Ink displays are bi-stable, drawing power only when updating the display. Consuming approximately 0.5 micro amps per cm^2 while switching the display, E Ink displays require zero power to display a static image.
- **Thinness** – E Ink Segmented display thickness can be between 380 and 560 microns.
- **Rugged** – E Ink Segmented displays are non-glass and shatterproof for added durability.
- **High contrast** – E Ink Segmented displays are daylight readable with a 180 degree viewing angle.
- **Design** – E Ink Segmented displays can be manufactured in any 2D shape such a circle, triangle, or abstract shape, enhancing industrial designs.

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www.micron.com

Micron Technologies, Inc.

Micron Technology is one of the world's leading providers of advanced semiconductor solutions. The company transforms foundational memory technologies – including DRAM, NAND Flash, and NOR Flash – into solid state drives (SSDs), modules, multichip packages, and other semiconductor systems. These innovative solutions are designed and manufactured for use in leading-edge computing, consumer, enterprise storage, networking, embedded, and mobile products.

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8000 South Federal Way
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tel: 208-268-4000

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Micron. Because 'Memory Matters'

There are many types of memory and usage models; whatever your memory needs, Micron has the solution. Our broad portfolio gives you selection and choice built with the Micron quality you know and trust. From DRAM and NAND, to NOR and PCM, our high-quality, high-performance solutions are cost-effective and tailored to suit a wide variety of applications.

Accelerate your time to market with DRAM components and modules, rigorously tested for high reliability in a wide range of applications. Choose from high-quality SDRAM, DDR, DDR2, DDR3 components, high performance modules, specialty RLDRAM and mobile LPDRAM.

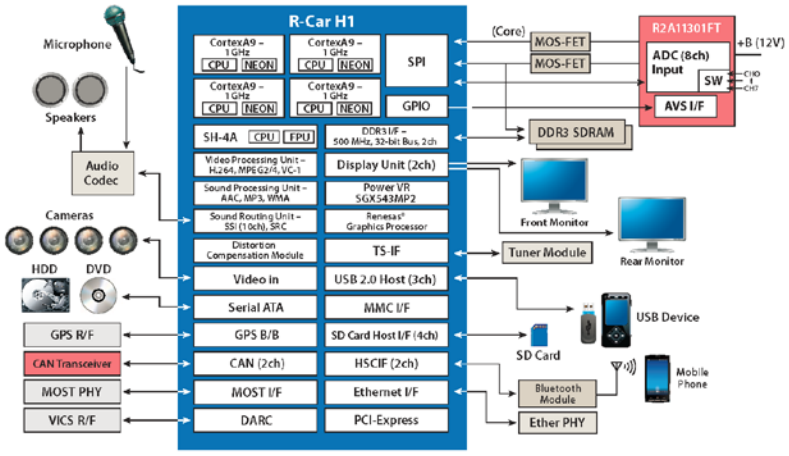
Choose high-performance NAND for everything from mobile to embedded to enterprise storage applications. Get SLC, MLC, or TCL NAND, available in industry-standard packages and ONFi compatible. We also have Serial NAND, Enterprise NAND, multi-chip packages, eMMC, SSD and professional-grade flash cards.

Are you looking for small, low-power, cost-effective NOR Flash for embedded and wireless applications? Our Parallel and Serial products are built on leading edge 65nm technology, come in multiple packages, command sets and security options, with extended lifecycle support.

Are you ready to try the latest memory technology innovation, Phase Change Memory? We have that too. This new memory features byte-alterability, or over-write capability, 1 million write cycles endurance and offers a long-term scaling path compared to flash. Available now in parallel and serial interface options. Micron is featuring a Renesas platform using PCM showing differences and benefits of using PCM vs. standard SPI NOR.

If Automotive grade solutions are what you need, we have that too. RAM, NAND, NOR and professional grade flash cards; full automotive grade certification for the quality and reliability required.

▶ *R-Car H1*



NOTES

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ON Semiconductor®

Enabling Energy Efficient Solutions

Product Overview

NCP2811: True Ground Stereo Headphone Audio Power Amplifier

For complete documentation, see the **data sheet**

Product Description

NCP2811 is a dual audio power amplifier designed for portable communication device applications such as mobile phones. This part is capable of delivering 27 mW of continuous average power into a 16 load from a 2.7 V power supply with a THD+N of 1%. Based on the power supply delivered to the device, an internal power management block generates a symmetrical positive and negative voltage. Thus, the internal amplifiers provide outputs referenced to Ground. In this NOCAP™ configuration, the two external heavy coupling capacitors can be removed. It offers significant space and cost savings compared to a typical stereo application. NCP2811 is available with an external adjustable gain (version A), or with an internal gain (version B). It reaches a superior PSRR and noise floor. Thus, it offers high fidelity audio sound, as well as a direct connection to the battery. It contains circuitry to prevent from Pop and Click noise that would otherwise occur during turn on and turn off transitions. The device is available in 12 bump CSP package (2 x 1.5 mm) which help to save space on the board.

Features

- NoCap™ Output Eliminate DC-Blocking Capacitors
- High PSRR : -100 dB
- Pop and Click protection circuitry
- Internal gain (-1.5 V/V) or external gain
- 2.7V-5.0V Operation
- Thermal overload protection circuitry

Benefits

- Save board area and component cost
- Direct connection to the battery
- High quality audio playback

Applications

- Stereo headphone amplifier

End Products

- Cellular phones
- Personal Digital Assistant and Portable Media Player
- MP3 Player
- Notebook PC

Part Electrical Specifications

Product	Compliance	Status	Class	Output Power Typ (W)	Output Type	Efficiency Typ (%)	t_{on} Typ (ms)	THD + N Typ (%)	I_Q Typ (mA)	I_{SD} Typ (nA)	Package Type
NCP2811ADTBR2G	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	TSSOP-14
NCP2811AFCT1G	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	Flip-Chip-12
NCP2811AMTTXG	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	WQFN-12
NCP2811BDTBR2G	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	TSSOP-14
NCP2811BFCCT1G	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	Flip-Chip-12
NCP2811BFCT1G	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	Flip-Chip-12
NCP2811BMTTXG	Pb-free Halide free	Active	AB	0.11			1	0.01	6	10	WQFN-12

www.palpilot.com

PalPilot

In 20+ years, PalPilot has positioned itself in three core industries; PCB Design, PCB Manufacturing, and Interconnect Products. Our roots in PCB Design have given us the experience to understand the unique and custom nature of the electronics industry. Our factories bring a complete supply chain of PCB manufacturing and interconnect products, which were assembled to add the greatest value to all of our customers' needs. We deliver low cost solutions, coupled with superior quality and service.

PALPILOT

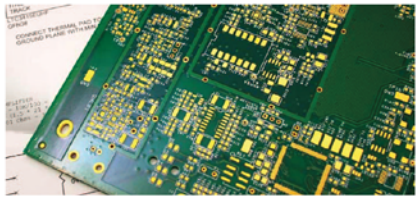
15991 Red Hill Ave., Suite 102
Tustin, CA. 92780
tel: 714-460-0718
fax: 714-460-0728
PalCONNSales@palpilot.com

ALLIANCE PARTNER RENESAS

Value Added Supplier of PCB Design Services, PCB Fabrication and Interconnect Products

PalPilot, a global company with a simple goal, "To Add Value!"

PalPilot's PCB Design division will work with your team throughout the entire process to quickly and efficiently deliver quality designs. Our customer-centric approach, coupled with 20+ years of experience and ongoing investment in state-of-the-art solutions, enables us to offer a design service to



meet the demands of today's leading edge technology, while being able to help customers with legacy requirements.

PalPilot's PCB manufacturing division offers solutions to meet your needs no matter the mix or volume. Our experienced sales teams will help every step of the way from design to development; and ownership in many of our offshore factories affords us production capacity to meet projects of all sizes. Business moves fast, that's why we pride ourselves in offering quick turnaround (5-10 days from Asia), so you can meet aggressive deadlines. Common types of PCB production we offer include: High Mix Low Volume (HMLV) Production For Low and High technology PCB's, Medium Volume Production 1-40 layer, High Volume Production 1-40 Layer, Flex and Rigid Flex, Prototype, small, medium, and high volume production.

PalPilot's Interconnect Product division manufactures standard connectors, custom connectors, cable and wire harness products. Our fully integrated in-house design, tooling and manufacturing utilizes state-of-the-art, fully automated processes providing world class quality, superior price performance and a flexibility unique to the interconnect market.

All products are manufactured to be fully compliant with worldwide efforts for the elimination of hazardous materials that meet ROHS requirements and are fully tested and recognized by UL and CSA. Our facilities are ISO-9001 certified, ISO/TS16949 registered.

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www.gainspan.com

GainSpan

GainSpan is a leader in low power embedded Wi-Fi and Wi-Fi connectivity for the Internet of Things. Its easy-to-use chips, modules and software, let customers leverage the large base of Wi-Fi access points and smartphones to create connected products for healthcare, smart energy and control/ monitoring in industrial, commercial and residential markets.

GainSpan Corporation
3590 N. First Street
Suite 300
San Jose, CA 95134
tel: +1 (408) 627-6500

GOLD PARTNER RENESAS

Enabling the Internet of Things Through Wi-Fi

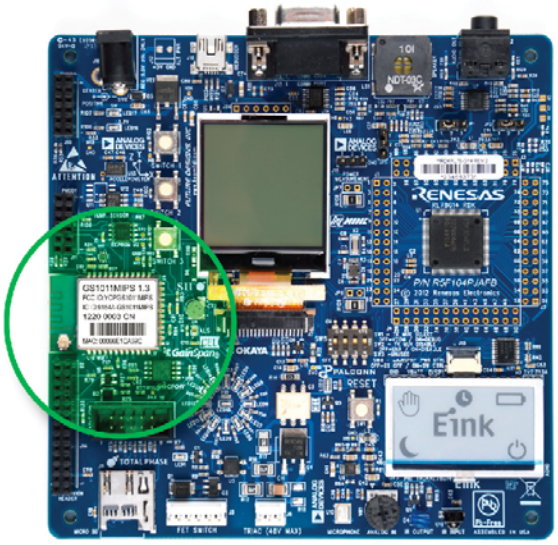
Build Connected Products

GainSpan is focused on a single goal – to make it quick and easy for device and appliance manufacturers to enable their products to connect to the Internet, and then to connect to smartphones/ PDAs for monitoring or control.

We do this with a complete line of low power embedded Wi-Fi products for customers in a wide range of markets. With our embedded products system designers now have ultra-low power Wi-Fi solutions that are simply unmatched – easy to use, quick to design in and cost-effective.

- Ultra low power chips and modules and fast wake up time
- Feature rich networking stack and services
- Client and Access Point mode
- Reference design code available for most Renesas MCUs
- Integrated on RL78G14 Renesas RDK

RENESAS RL78



Visit us at our online store and see how we can help you connect Things to the Internet and People to Things.

NOTES

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www.exosite.com

Exosite

We are a software technology company focused on connecting devices and systems. Our cloud-based data platform makes it easy to put real-world information online where the right people – and systems – can interact with it.

Exosite
227 Colfax Avenue
North Suite 150
Minneapolis, MN 55041
tel: 612.353.2161
email: support@exosite.com

GOLD PARTNER RENESAS

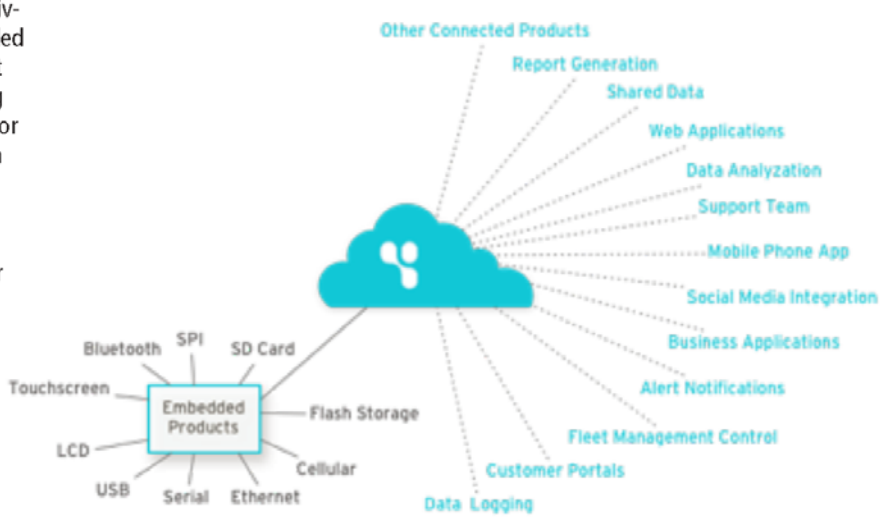
Use the Cloud as a Peripheral for your RX & RL Development Kits to Create Powerful, Extensible M2M Applications

Build Connected Products

User expectations for the features of industrial & medical products follow that of the consumer paradigm. In the late 90's, the team here at Exosite helped industrial & medical product developers when they were faced with a demand for color LCDs, touch screens and wired connectivity. In the last decade, wireless connectivity, mass storage and low-power-operation have been common design additions.

Today's consumers have the expectation of always-on connectivity & access to data – the embedded paradigm is embarking on a quest for connectivity. Exosite is leading the charge on cloud connectivity for devices with our cloud-based data platform, embedded API libraries and web dashboards. We provide an enterprise-grade cloud service – and the tools to make it easy for embedded product developers to use.

▶ *Utility of the cloud as a peripheral for embedded systems*



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CEL California Eastern Laboratories

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RENESAS
Renesas (formerly NEC Electronics) is a Worldwide Leader for Switch ICs.
A Business Partner of Renesas Electronics Corporation
CEL California Eastern Laboratories
Learn more

CEL and Renesas Electronics

California Eastern Laboratories (CEL) is the exclusive sales and marketing partner in North America and Latin America for products made by the Compound Semiconductor Devices Business Division (CSDBD) of Renesas Electronics Corporation.

Learn More

Applications / Markets Served

CEL serves designers, OEMs and contract manufacturers in the RF & Wireless, Mobilecomm, Multimedia, Broadband Communications, Industrial Control, and Factory Automation markets.

Learn More

Renesas Electronics America Inc.

Renesas is a leading global supplier of advanced semiconductor solutions, offering an extensive line of 8/16/32-bit microcontrollers for a wide span of applications, plus a broad range of analog and power devices, LCD modules, and more. The many Renesas demonstrations on display at DevCon illustrate the capabilities of products recommended for new designs, focus on solutions to key design challenges in various market segments, and highlight new technology trends.

Renesas Electronics America Inc.
2880 Scott Boulevard
Santa Clara, CA 95050-2554
tel: 1-408-588-6000

Renesas Ecosystems: a Wealth of Support is just a Click Away, as Well as Powerful Demonstration Kits

Renesas Ecosystems

Alliance Partner Program

- The Alliance Partner Program allows you to connect instantly with hundreds of qualified design consulting & contracting professionals.

am.renesas.com/alliance

Renesas Interactive

- Gain the technical knowledge you need. Evaluate, research, and learn at your own pace, where and when you want, for free.

www.renesasinteractive.com

Renesas Rulz Forums

- A forum and community site to share technical information, questions and opinions with others who use Renesas MCUs & MPUs.

www.renesasrulz.com

Renesas University Program

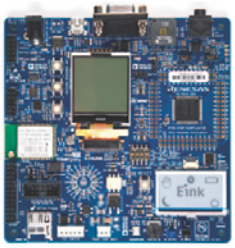
- For educators and students. Teach with professional grade tools. Learn MCUs with a modern architecture.

www.renesasuniversity.com

Demonstration Kits

NEW RL78G14 RDK Many enhancements vs. RL78G13

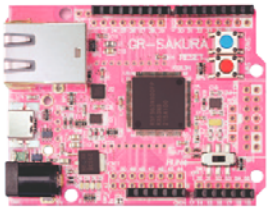
- Factory Wi-Fi 802.11b module (Gainspan) and Cloud support, New zero-power LCD technology with E-Ink LCD, New RL78G14 with 256KB flash, larger SRAM, new MC timer.



www.renesas.com/RDKRL78G14

NEW GR-Sakura (Arduino-Compatible)

- Renesas board "Sakura" w/RX63N Arduino-compatible (HW & SW) Web-based compiler (Win and Android) – Launch in 2013



www.renesas.com/products/promotion/gr/index.jsp

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11.2. Renesas Contact Information

For details on how to use Renesas Eclipse tools (e2studio), refer to the e2studio website at:

For information about the RL78 series microcontrollers refer to the RL78 Family hardware manual.

For information about the RL78 assembly language, refer to the RL78 Family Software Manual.

Online technical support and information is available at: http://www.renesas.com/renesas_starter_kits

Technical Contact Details

America: techsupport.rta@renesas.com
Europe: tools.support.eu@renesas.com
Japan: csc@renesas.com

General information on Renesas Microcontrollers can be found on the Renesas website at: http://www.renesas.com/

Renesas Demonstration Kit (RDK) for RL78G14

User's Manual

Publication / Date Rev.1.00 / Oct 12 2012

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Mass-Market Group

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